UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/654,501	09/01/2000	Yuji Takahashi	PM 273792	7004

909 7590 04/08/2002

PILLSBURY WINTHROP, LLP
P.O. BOX 10500
MCLEAN, VA 22102

EXAMINER
BAUMEISTER, BRADLEY W

ART UNIT	PAPER NUMBER
2815	

DATE MAILED: 04/08/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/654,501	Applicant(s) Takahashi et al.
	Examiner B. William Baumeister	Art Unit 2815

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on *Feb 20, 2002*

2a) ☐ This action is **FINAL.** 2b) ☒ This action is non-final.

3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

4) ☒ Claim(s) *1-37* is/are pending in the application.

4a) Of the above, claim(s) _____ is/are withdrawn from consideratio

5) ☐ Claim(s) _____ is/are allowed.

6) ☒ Claim(s) *1-37* is/are rejected.

7) ☐ Claim(s) _____ is/are objected to.

8) ☐ Claims _____ are subject to restriction and/or election requirement

Application Papers

9) ☒ The specification is objected to by the Examiner.

10) ☐ The drawing(s) filed on _____ is/are objected to by the Examiner.

11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved.

12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

13) ☒ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

a) ☐ All b) ☐ Some* c) ☒ None of:

1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

*See the attached detailed Office action for a list of the certified copies not received.

14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

15) ☒ Notice of References Cited (PTO-892)

16) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

17) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s). *3*

18) ☐ Interview Summary (PTO-413) Paper No(s). _____

19) ☐ Notice of Informal Patent Application (PTO-152)

20) ☐ Other:

DETAILED ACTION

Priority

1. Acknowledgment is made of applicant's claim for foreign priority based on an applications filed in Japan on 9/2/1999 and 12/17/1999. It is noted, however, that applicant has not filed certified copies of the foreign applications as required by 35 U.S.C. 119(b).

a. In the REMARKS section of paper #6, entered 2/20/2002, Applicant (1) avers that certified copies of the priority documents were submitted with the Application on 9/1/2000; (2) states that copies of the front pages are attached to the response of paper #6; and (3) requests acknowledgment of receipt of the priority documents. As the certified priority documents have not been placed in the file-wrapper, their receipt cannot be acknowledged by the Examiner. Whether providing copies of their front pages is sufficient need not be addressed as no such copies were, in fact, attached to the response.

Specification

2. The disclosure is objected to because of the following informalities:

a. the specification states that ZnS:Eu; YVO4:Ce; and Y2O2S:Ce emit red light (e.g., page 3, lines 14-17; page 6, lines 6-16). The specification alternatively states that these materials emit green light (page 14, lines 4-12).

b. The specification states (page 14, lines 4-12) that ZnS:Mn; Y2O2S:Eu and YVO4:Eu emit green light. The Phosphor Handbook teaches that ZnS:Mn emits orange light

(page 252); and that YVO4:Eu and Y2O2S:Eu emit red light (page 394 for YVO4:Eu, supplied in previous Office Action and page 190 for Y2O2S:Eu).

Appropriate correction is required.

Claim Objections

3. Claims 22-24, 35 and 37 are objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form.

a. Regarding claim 22, independent claim 21 recites, "a second light source including a first fluorescent material configured to absorb light... [and] emit green light. Dependent claim 22 recites a Markush group of fluorescent materials of which this green emitting material may be composed. The Markush group includes ZnS:Mn; ZnS:Eu; YVO4:Ce; Y2O2S:Eu and Y2O2S:Ce. Either the specification (e.g., page 3, lines 14-17) or else the Phosphor Handbook states that these materials with the Ce and Eu activators emit red light and that the ZnS:Mn emits orange light. As such, the claim does not further limit the subject matter of the independent claim.

i. Claim 22 also has a typo: "ZnS:Cu, Au, AL" ("AL" should be "Al").

b. Regarding claims 23 and 24, independent claim 21 has been amended to recite, "a third light source comprising a red color LED configured to emit red light;..." Dependent claims 23 and 24 alternatively recite that the third light source includes a second fluorescent material

(claim 23) and that this second fluorescent material is composed CaS:Eu (claim 24). As such, the substitution of the fluorescent material for the LED does not further limit the subject matter of the independent claim.

c. Regarding claim 35, independent claim 11 recites a Markush group for the first fluorescent material of the second light source that consists of three phosphors. Dependent claim 35 expands this Markush group to include about five additional phosphors. As such, the claim does not further limit the subject matter.

d. Regarding claim 37, independent claim 11 has been amended to recite, "a third light source including a second fluorescent material configured to absorb light of said primary light source, the third light source being configured to emit red light,..." Dependent claim 37 recites that the third light source includes "a semiconductor light-emitting device." The examiner notes that the red phosphors set forth in claim 11 and electroluminescent devices (such as LEDs and laser diodes) are both semiconductor light-emitting devices, but regardless, it appears that Applicant intends this claim language to read on an electroluminescent semiconductor device. As such, the substitution of the LED for the fluorescent material does not further limit the subject matter of the independent claim. Further, if Applicant means this term to red on a phosphor, it does not narrow the claim 11 because claim 11 already sets forth phosphors that are specific semiconductor light-emitting devices that emit red light.

Claim Rejections - 35 USC § 112

4. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

5. Claims 23, 24, 36 and 37 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The above 112-4th objections were based on an interpretation that those claims meant that one of the red phosphor and the red LED was substituted for the other. Alternatively, if claims 23, 24 and 37 are interpreted to mean that the device includes both the red LED and the red phosphor, these claims improperly present new matter, as the specification does not teach employing both red phosphors and red LEDs in the same device.

a. Regarding claim 36, the specification does not appear to disclose using two different red phosphors in the same device.

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7. Claims 12-20, 21-34 and 37 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

a. Regarding claims 12-20, claim 12 recites the limitation "said fluorescent material" in line 6. As independent claim 11 has been amended to recite both "a fluorescent material" and "a second fluorescent material," there is insufficient antecedent basis for this limitation in claim 12, rendering it unclear whether "said fluorescent material" refers to the first material of claim 11 or both materials.

b. Regarding claims 21-34, claim 21 recites the limitation "said primary light source" in line 5. There is insufficient antecedent basis for this limitation in the claim. Rather, the claim previously sets forth "a first light source including a semiconductor light-emitting device configured to emit blue light," and it would be unclear to one skilled in the art whether the claim requires the second light source to absorb the blue light emitted from the first light source, or alternatively whether it could emit blue or UV from a primary source that is separate from the first light source.

c. Regarding claim 22, independent claim 21 recites, "a second light source including a first fluorescent material configured to absorb light... [and] emit green light. Dependent claim 22 recites a Markush group of fluorescent materials of which this green emitting material may be composed. The Markush group includes ZnS:Eu; YVO4:Ce; Y2O2S:Eu and Y2O2S:Ce. As was mentioned earlier herein, these materials emit red light. Further, ZnS:Mn emits orange light. As

such, it would be unclear to the skilled artisan whether claim 22 is intended to be limited to green-emitting materials, or whether materials that emit other colors may be employed.

d. Regarding claims 23, 24 and 37 it would be unclear to one skilled in the art whether the claim intends to mean that only one of the red phosphor and the red LED is employed (one is substituted for the other) or whether both are employed in the same device.

Claim Interpretations

8. This section does not contain objections or rejections. Rather, it explains how the claims are being interpreted by the Examiner in light of the foregoing non-art objections and rejections, and sets forth rationales behind various art-based rejections subsequently set forth below in the following sections.

a. The official, amended version of claim 1 does not match the marked-up version of the claim. The official version controls.

b. Claims 11-20 are interpreted to require that the Markush group set forth for the green phosphor is intended to be directed towards the red phosphor since all of the phosphors of the group are red.

c. Claim 36 is interpreted to require the use of the CaS:Eu red phosphor instead of one of those listed in the Markush group of claim 11.

d. Claim 37 is interpreted to require the use of a red-emitting electroluminescent device instead of a red phosphor.

e. Claims 22 and 35 are interpreted as setting forth a Markush group of phosphors emitting green light consisting of ZnS:Cu, Au, Al and ZnS:Cu since the rest of the listed phosphors emit red or orange light.

f. Claims 23 and 24 are interpreted to require the use of a red-emitting phosphor instead of a red LED. Claim 24 requires that it be CaS:Eu.

Claim Rejections - 35 USC § 102 / § 103

9. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless --
>
> (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371© of this title before the invention thereof by the applicant for patent.

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

11. Insofar as definite and in light of the claim interpretations set forth above, claims 1-3, 8, 10, 23, 24 and 36 rejected under 35 U.S.C. 102(e) as anticipated by Soules et al. '254 or, in the

alternative, under 35 U.S.C. 103(a) as obvious over Soules '254 in view of Shimoyama et al. '834.

a. Soules discloses LEDs or laser diodes that emit primary, blue light in the range of 420-470 nm (col. 3, lines 57-60). The LED is covered with a phosphor-containing polymer layer 15 and clear polymer lens 16 (e.g., FIG. 2), and both of these materials may be composed of the same material such as silicone (col. 3, lines 50-56). Various phosphors are employed so that a portion of the blue light emitted from the semiconductor device is absorbed and the phosphors emit secondary, green and red light respectively, so that the primary and secondary colors are blended to produce various colors including white light.

b. Regarding claim 8, since polymer layer 15 contains the phosphors and polymer layer 16 is composed of the same material as layer 15, but does not possess phosphors, the structure reads on a polymer layer having a step-graded phosphor profile.

c. Regarding claims 23, 24 and 36, Soules teaches that the red phosphor may be composed of (Ca, Sr)S:Eu where $0 \leq Sr \leq 1$; or CaS:Eu (e.g., col. 2, lines 1-25).

d. Claim 1 has been amended to now include a limitation relating to the presence of a reflector interposed between the semiconductor substrate and the light-emitting portion thereof. Soules states that the blue light emitter may be either an LED or a laser diode (LD). Since so many conventional laser diodes (e.g., VCSELs) include optical confinement means such as distributed Bragg reflectors disposed between the substrate and active region (a bottom reflector), one skilled in the art would have understood or inferred that the express recitation of an LD

further implies that a bottom reflector may be present in the emitter. Under this interpretation, the claims are anticipated.

e. Alternatively, assuming *arguendo* that Soules must be interpreted so narrowly as not at least implicitly disclosing the presence of a bottom reflector, the claims would nonetheless be obvious in view of Shimoyama et al. '834. Shimoyama is directed towards a GaInN (i.e., blue) LED and discloses that DBRs are commonly employed in LEDs and LDs for the purpose of reflecting light towards the device's surface and thereby improving the light emission efficiency. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to provide the LED or LD of Soules with a bottom reflector for the purpose of increasing the light emission efficiency as taught by Shimoyama.

12. Claims 4-7 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Soules 254 or Soules-Shimoyama as applied to the claims above, and further in view of Butterworth et al. '507.

a. Soules discloses the elements as set forth above and also discloses that the phosphor layer 15 is covered with a bullet-shaped sealing member 16 which are both composed of the same material, as set forth in claims 5-7 and 9, but does not appear to mention the presence of conventional structures such as a lead frame having a cup-shaped portion. Butterworth discloses UV/blue LEDs disposed in a cup-shaped reflector/lead frame and which are overcoated with any of various bullet-shaped, fluorescent-dye-containing epoxies 240. One phosphor listed is the

green-emitting ZnS:Cu,Al,Au (col. 3, line 54). Butterworth also states that depending on the implementation, some unabsorbed original blue light may also pass through the lens (col. 2, lines 64, 65) and states that multiple dyes can be employed to produce white light (i.e., also use a red dye) (col. 3, line 5). Thus, it would have been obvious to one or ordinary skill in the art at the time of the invention to dispose the device taught by Soules or Soules-Shimoyama on a cup-shaped portion of a lead frame as taught by Butterworth for the purpose of providing a receptacle for supporting the chip and the polymer and/or for increasing the light emission efficiency by reflecting laterally-directed light upward.

13. Claims 11-13, 18, 20 and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Soules 254 or Soules-Shimoyama as applied to the claims above, and further in view of Hampden-Smith et al. '123. Soules discloses various phosphors that may be used for red-light photoluminescence, but does not appear to disclose any of the specific phosphors recited in the Markush group of claim 11 (ZnS:Eu, YVO4:Ce and Y2O2S:Ce). Hampden-Smith '123 teaches various sulfur-containing phosphors that can be used in an array of applications including photoluminescence (col. 35, lines 28-33). These phosphors include ZnS:Eu (red, claim 11) (paragraph spanning cols. 35-36); and ZnS:Cu (Table 1, col. 37) and ZnS:Cu, Au, Al (col. 36, lines 8-15), the latter two for various hues of blue/green. It would have been obvious to one of ordinary skill in the art at the time of the invention to employ within the light emitter of Soules or Soules-Shimoyama, any of the phosphors specifically mentioned in Hampden-Smith for any of

various reasons such as: (1) to obtain the particular hue associated with the specific phosphor or (2) for business reasons such as relating to the cost and availability of a particular phosphor.

14. Claims 14-17 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Soules--Hampden-Smith or Soules--Shimoyama--Hampden-Smith as applied to claims 11-13, 18, 20 and 35 above, and further in view of Butterworth et al. '507. As was explained previously hereinabove, regardless of whether any of the base references mentions the presence of a lead frame having a cup-shaped portion, Butterworth discloses UV/blue LEDs disposed in a cup-shaped reflector/lead frame and which are overcoated with any of various bullet-shaped, fluorescent-dye-containing epoxies 240. One phosphor listed is the green-emitting ZnS:Cu,Al,Au (col. 3, line 54). Butterworth also states that depending on the implementation, some unabsorbed original blue light may also pass through the lens (col. 2, lines 64, 65) and states that multiple dyes can be employed to produce white light (i.e., also use a red dye) (col. 3, line 5). Thus, it would have been obvious to one or ordinary skill in the art at the time of the invention to dispose the device taught by Soules--Hampden-Smith or Soules--Shimoyama--Hampden-Smith on a cup-shaped portion of a lead frame as taught by Butterworth for the purpose of providing a receptacle for supporting the chip and the polymer and/or for increasing the light emission efficiency by reflecting laterally-directed light upward.

15. Claims 21, 25-27, 32, 34 and 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Soules 254 or Soules-Shimoyama as applied to the claims 1-3, 8, 10, 23, 24 and 36 above, and further in view of Thompson et al. '489. Soules teaches blue-emitting semiconductor LEDs overcoated with downconverter phosphors as explained above, but does not disclose the device used in combination with an additional red LED.

a. Thompson teaches a full-color LED assembly comprising two LEDs and a photoluminescent downconverter phosphor disposed for re-emission of longer wavelength light in response to light that is emitted from only one of the two LEDs. The phosphor may either emit green or red light. The LED that is not in communication with the downconverter phosphor may emit red light. Through the use of the combination of an LED with a phosphor and an LED without a phosphor, different colors of light can be selectively obtained subsequent to manufacturing.

b. It would have been obvious to one of ordinary skill in the art at the time of the invention to have employed a blue LED overcoated with a green-emitting phosphor as taught by Soules 254 or Soules-Shimoyama as explained above in combination with a red LED instead of an additional red phosphor for the purpose of obtaining white light emission while simultaneously enabling increased post-manufacturing color control beyond that enabled by a blue LED overcoated with green and red phosphors at least for any of the purposes of (1) providing an assembly that can selectively emit various desired colors (e.g., red, blue and green, or white); (2) enabling later color readjustment in the event that the amount of blue or green light degrades or

otherwise changes over time; or (3) providing an assembly wherein the red color is not subject to color alteration attributable to phosphor degradation. Further, it would have been obvious to use a red-emitting LED for the LED which does not produce secondary phosphor re-emission, since Soules and Thompson teach the use of down-converting phosphors (i.e., phosphors wherein higher-energy, shorter wavelength colors are absorbed and re-emitted as lower-energy, longer wavelength colors), and red is the lowest energy, longest wavelength color of blue, green and red, thereby ensuring that regardless of the assembly's configuration or the two LEDs' relative disposition, any spurious light from this second LED will not cause any significant secondary re-emission in the phosphor.

16. Claims 22, 28-31 and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Soules-Thompson or Soules-Shimoyama-Thompson as applied to the claims 21, 25-27, 32, 34 and 37 above, and further in view of Butterworth et al. '507. As was explained previously, regardless of whether any of the base references mentions the presence of a lead frame having a cup-shaped portion, Butterworth discloses UV/blue LEDs disposed in a cup-shaped reflector/lead frame and which are overcoated with any of various bullet-shaped, fluorescent-dye-containing epoxies 240. One phosphor listed is the green-emitting ZnS:Cu,Al,Au (col. 3, line 54), as set forth in claim 22. Butterworth also states that depending on the implementation, some unabsorbed original blue light may also pass through the lens (col. 2, lines 64, 65). It would have been obvious to one or ordinary skill in the art at the time of the invention to dispose the device

taught by Soules--Thompson or Soules--Shimoyama--Thompson on a cup-shaped portion of a lead frame as taught by Butterworth for the purpose of providing a receptacle for supporting the chip and the polymer and/or for increasing the light emission efficiency by reflecting laterally-directed light upward.

Response to Arguments

17. Applicant's arguments with respect to the claims have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

18. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

a. Tang et al. '870 and Tanaka '289 disclose 3-color displays wherein organic electroluminescent LEDs emit blue light. Some of the light is absorbed by various phosphors which, in turn, re-emit green and red light by photoluminescence.

b. Tischler '074 and Hayafuji et al. '321 disclose bottom reflectors for III-N LEDs.

c. Tarsa et al. '041 teaches a multiple-lamp assembly wherein one of the lamps is coated with a phosphor for downconverting UV to yellow so that in combination with another blue lamp, the device will emit white light.

d. Komoto et al. '824, directed towards a UV emitting LED which is overcoated with blue, green and/or red phosphors, depicts various single and multiple LED/cup/encapsulant configurations that would be usable in other LED systems.

e. JP 10-11002 depicts a two-LED chip assembly for emitting white light.

f. McIntosh et al. '905 discloses GaN-based multicolor LEDs wherein blue, green and red are achieved by altering the In content of the respective active layers. The reference teaches that independent bias control of each active layer is beneficial for tailoring the light emission and to selectively change the effective color (e.g., col. 2, lines 55-).

INFORMATION ON HOW TO CONTACT THE USPTO

19. Any inquiry concerning this communication or earlier communications from the examiner should be directed to the examiner, **B. William Baumeister,** at **(703) 306-9165.** The examiner can normally be reached Monday through Friday, 8:30 a.m. to 5:00 p.m. If the Examiner is not available, the Examiner's supervisor, Mr. Eddie Lee, can be reached at (703) 308-1690. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956.

B Wm Baum

B. William Baumeister

Patent Examiner, Art Unit 2815

April 4, 2002